

Application No.: 10/511,622
Amendment Dated: April 23, 2008
Reply to Office Action of: January 29, 2008

MAT-8605US

Amendments to the Drawings:

The attached sheet of drawings includes changes to Figure 44. This sheet replaces the original sheet.

Remarks/Arguments:

The present invention relates to a technique for impulse communication. Specifically, multiple narrow band sub-carrier signals are multiplexed in frequency.

On page 2, the Official Action objects to Fig. 44 because it should be designated as "PRIOR ART." Thus, Applicants have amended Fig. 44 to have the legend --PRIOR ART--. Withdrawal of the objection is respectfully requested.

On page 2, the Official Action objects to the title of the invention not being descriptive. Thus, Applicants have amended the title to recite: "COMMUNICATION APPARATUS AND COMMUNICATION METHOD UTILIZING MULTIPLE CARRIER WAVES FOR OVERCOMING INTERFERENCE." Withdrawal of the objection is respectfully requested.

On page 2, the Official Action rejects claims 1-34 under 35 U.S.C. § 103(a) as being unpatentable over Fullerton (U.S. Patent No. 5,677,927, hereinafter "FullertonA") in view of Fullerton (U.S. Patent No. 5,687,169, hereinafter "FullertonB"). It is respectfully requested, however, that the claims are patentable over the art of record for at least the reasons set forth below.

FullertonA teaches an ultra wideband communication system. Specifically, multiple subcarriers are used in an impulse modulation system. FullertonB teaches an impulse radio transceiver for ultra wideband communications. Specifically, the pulses are interleaved to avoid self-interference between transmitted pulses.

Applicants' invention, as recited by claim 1, includes a feature which is neither disclosed or suggested by the art of record, namely:

... generating a plurality of subcarriers modulation signals, at least two of the subcarriers, including the same data ...

... a filter section for outputting a plurality of transmission signals, the transmission signals being band-limited of the plurality of subcarrier-transmission signals ...

Claim 1 relates to the transmission of multiple band-limited subcarriers. Specifically, the impulse modulation subcarriers are filtered to become band-limited transmission signals where they are then multiplexed in frequency. This feature is found in the originally filed application on page 14, line 23 to page 15, line 2, and furthermore, in Fig. 3. No new matter has been added.

FullertonA discloses an ultra wideband transmission that is generated by impulse modulation. Specifically, col. 3, lines 34-40 of FullertonA teaches a pseudo random code sequence that is used to spread the modulated signal over an ultra wideband ("the *code control signal corresponding to the PN code used by an impulse radio transmitter communicating an impulse radio signal*"). This feature is shown in Fig. 10 as code source 1006. Furthermore, in Fig. 10 the subcarriers are then modulated in time by modulator 1016 and then transmitted. Therefore, the subcarriers vary in time with respect to a pseudo random sequence and are **not filtered** with respect to frequency (the signal is ultra wideband, not band limited). A typical example of an ultra wideband spectrum is shown in FullertonA's Fig. 4. Col. 18, lines 26-44 and Fig. 17 of FullertonA also goes on to teach different data sources being modulated with the multiple sub-carriers ("voice information source (VIS) ... digital data source (DDS) ... digital control information source (CIS)"). Thus, FullertonA teaches each subcarrier being modulated with **different data** from each other.

FullertonB also teaches an ultra wideband system that utilizes impulse modulation. In col. 9, lines 59-61, FullertonB teaches that his system is ultra wideband and not narrow band ("since *ultra wideband signals utilize the full electromagnetic spectrum, or at least a very large portion of it, it is necessary to use some technique other than frequency domain duplexing*"). Furthermore, Applicants respectfully disagree with page 4 of the Official Action where the Examiner states that col. 9 of FullertonB suggests communication based on information amount, significance and propagation condition.

Applicants' claim 1 is different than FullertonA and FullertonB, because multiple subcarriers are modulated with the **same data** and the transmission signals are filtered to become **band limited** ("the *plurality of subcarriers modulation signals, at*

least two of the subcarriers, including the same data ... a filter section for outputting a plurality of transmission signals, the transmission signals being band-limited of the plurality of subcarrier-transmission signals"). On page 15, lines 17-20 of the specification, it is taught that the subcarriers are modulated with the **same data** ("impulse modulation wave is generated corresponding to transmission data, to output a subcarrier modulation signal in an amount of a predetermined number of subcarriers. The subcarriers are attached with the same symbol"). On page 14, lines 24-27 of the specification, Applicants go on to teach that the modulated plurality of subcarriers are then filtered to become **band limited** and then multiplexed ("signal outputted from the transmission section 205 is band limited in its subcarriers by the filter section 250 so that a multiplex transmission signal is supplied to the antenna section 101").

By modulating the **same data on a plurality of subcarriers**, Applicants are able to overcome deterioration due to a narrow band interference. For example, Applicants' Fig. 12 shows the same data being modulated on seven subcarriers f1-f7. Signals f1-f7 are band limited due to the filtering section in the transmitter. It is also shown that interfering wave 1202 has a high amplitude in the vicinity of subcarriers f4 and f5. Therefore, since f4 and f5 are corrupted by interfering wave 1202, f4 and f5 are discarded (filtered out). Thus, the data can still be demodulated correctly using the remaining sub-carriers f1, f2, f3, f6 and f7. This feature is supported on pages 17-18 of the specification ("deterioration in the communication condition in subcarriers f4, f5 under heavy influence of the disturbing wave shown in Fig. 12 ... however, concerning the other subcarriers f1 - f3, f6, f7, the disturbing wave is band-limited by the filter 201 as shown in Fig. 13C with a result that the major part of disturbing wave power is removed to obtain high C/N ... For this reason, communications can be sustained in a favorable state by demodulation with the use of subcarriers f1 - f3, f6, f7 shown in Fig. 12"). By modulating the same data on multiple narrow band subcarriers, deteriorated sub carriers due to interfering waves can be filtered out and the remaining subcarriers can be utilized to demodulate the information.

Applicants include the feature of "plurality of subcarriers modulation signals, at least two of the subcarriers including the same data ... a filter section for outputting a plurality of transmission signals, the transmission signals being band-limited of the

plurality of subcarrier-transmission signals," that the following advantages are achieved. An advantage is the ability to utilize the subcarriers that are not deteriorated due to interfering waves and filtering out those carrier waves which are deteriorated by interfering waves. Accordingly, for the reasons set forth above, claim 1 is patentable over the art of record.

Independent claim 32 includes similar features to claim 1. Claim 32 further recites a step wherein a particular subcarrier is selected based on its reception power. This feature is supported in Fig. 12 and on pages 17 and 18 of the specification. On page 10 of the Official Action, the Examiner suggests that col. 28 lines 17-39 of FullertonA discloses this feature. Applicants, however, respectfully disagree. FullertonA merely teaches measuring power of a wide band signal. FullertonA does not suggest measuring reception power of narrow band subcarriers and then selecting carriers based on their measured power. Thus, claim 32 is also patentable over the art of record for at least the reasons set forth above.

New dependent claim 35 has been added to the application. Claim 35 recites that the sub-carriers are controlled depending on information amount, significance and communication propagation condition. On page 4 of the Official Action, the Examiner suggests that col. 9 lines 45-65 of FullertonB discloses this feature. Applicants, however, respectfully disagree. Column 9 of FullertonB does not say anything about information amount, significance and propagation condition. Furthermore, this claim is patentable by virtue of its dependency on allowable claim 1.

Support for this claim can be found in the specification as originally filed on page 26, lines 14-17 and page 46, lines 12-20. No new matter has been added.

Dependent claims 2-31 and 35 include all of the features of claim 1 from which they depend. Thus, claims 2-31 and 35 are also patentable over the art of record for at least the reasons set forth above.

Dependent claims 33 and 34 include all of the features of claim 32 from which they depend. Thus, claims 33 and 34 are also patentable over the art of record for at least the same reasons as those set forth above.

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In view of the amendments and arguments set forth above, the above-identified application is in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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RAE/dmw

Attachment: Figure 44 (1 sheet)

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